Some Aquatic Fungi Imperfecti from Hawaii

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FRESH-WATER hyphomycetes from tropical locations have been reported by Ingold (1956, 1958, 1959, 1960), Dixon (1959), Greathead (1961), Hudson (1961), Hudson and Ingold (1960), and Nilsson (1962). Reports from the Pacific area include California (Ranzoni, 1953), and Japan (Tubaki, 1957, 1960; Suzuki and Nimura, 1960*a, b;* and Nimura, 1960).

The Fungi Imperfecti reported in this paper were collected from streams in the Na Pali Kona Reserve on the island of Kauai, Hawaii, during August 1961. Collections were taken from the Kokee, Waineki, Elekiniki, Kauaikinana, and Kawaikoi streams, and from roadside ditches. At that time the streams were full and foam and scum were abundant.

Most of the species reported here were identified from spores collected in foam and scum. Colonies developing on rotting leaves, collected from the same group of streams, confirmed the identification of many of these fungi. The extremely rich flora of Fungi Imperfecti included the following species:

Alatospora acuminata Ingold
Anguillospora crassa Ingold
Anguillospora flagellifera Ingold
Articulospora tetracladia Ingold
Articulospora inflata Ingold
Campylospora chaetocladia Ranzoni
Chaetospermum chaetosporum (Pat.) A. L. Smith and Ramsb.
Clavariopsis aquatica De Wild.
Lemonniera aquatica De Wild.
Lunulospora curvula Ingold
Tetrachaetum elegans Ingold
Tricladium angulatum Ingold
Tricladium anomalum Ingold
Tricladium gracile Ingold
Tricladium splendens Ingold
Triscelophorus monosporus Ingold
Varicosporium elodeae Kegel

In addition to the above, vermiform spores similar to those of *Anguillospora gigantea* Ranzoni, *A. pseudolongissima* Ranzoni, *Flagellospora curvula* Ingold, and *F. penicilliodes* Ingold were common in scum and foam. However, these could not be identified with any degree of certainty since they did not develop on the leaf material observed. *Monochaetia* and *Pestalotia* spores were also very common in foam.

Several unidentified spore types were observed, but the most common one closely resembled spores of a possible species of *Articulospora* illustrated by Ingold (1958:111). At least 50 spores of this type were observed on two slides made from foam collected from Kokee Stream. Spore size, septation, and manner of articulation are as described by Ingold.

Leaves collected from the streams were plated out in about 1/4 inch of distilled water. After about 6 weeks, tetraradiate spores developed abundantly above the water surface. This fungus produced aleuriospores consisting of an elongate, septate main axis continuous with the aleuriophore and with elongate secondary branches arising from the lower part of the main axis. Superficially they resemble spores produced by species of *Triscelophorus* (Petersen, 1962:131–134). However, on the basis of the type of conidiophore, the morphology of the main axis of the spore, the manner in which the appendages are produced, and the fact that there are always a few spores produced which lack appendages, I have decided to consider it a species of *Dactylella.*

Dactylella appendiculata sp. nov.

Fungus aquaticus; mycelium septatum, hyalinum, ramosum; cellulae 8–65 × 1.5–4 μ; aleuriophori 50–400 × 1.5–4 μ, septati, hyalini, simplices, summersi vel ex aqua emergentes; aleuriospori, apicati, hyalini, plerumque e quattuor bracchiis, singillatim producti; axis principalis 57–108 ($\bar{x} = 84$) × 9.3–14.5 μ, ex 5–8 cellulis; bracchia divergentia septata, orientia e secunda cellula axis principalis, 10–136 ($\bar{x} =$

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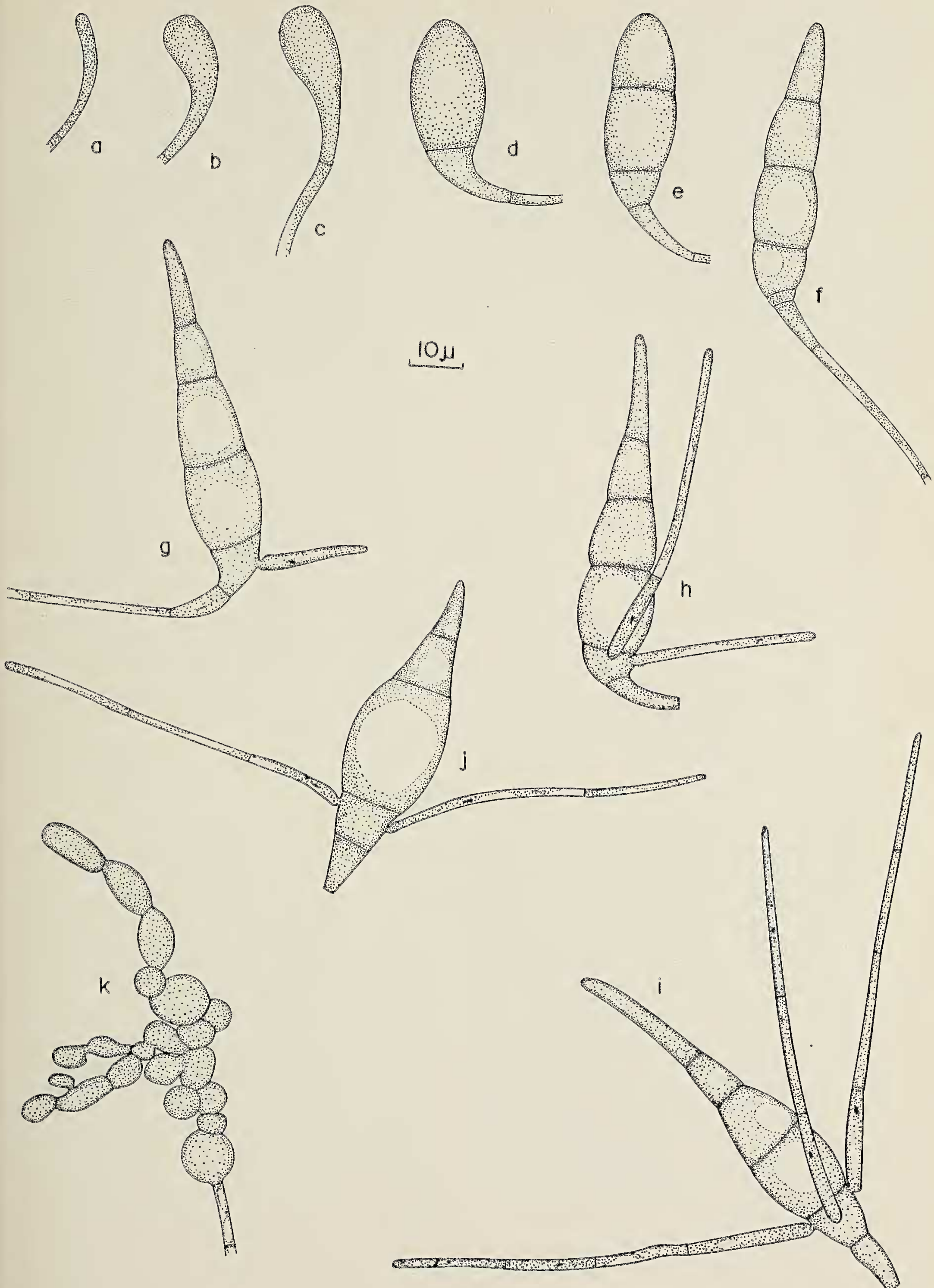

FIG. 1. *Dactylella appendiculata*. *a–h*, Stages in the development of aleuriospores from curved spore primordia. *i*, Mature aleuriospore which developed from a curved spore primordium. *j*, Mature aleuriospore which developed from a straight spore primordium. *k*, Resting cells from agar culture.

87) × 2–3.5 μ, constricta in basi; cellulae in catenis ramosis dormientes, 5–23 μ diam.

Aquatic fungus; mycelium septate, hyaline, branching; cells 8–65 × 1.5–4 μ; aleuriophores 50–400 × 1.5–4 μ, septate, hyaline, unbranched, submerged or emerging from the water; aleuriospores apical, hyaline, produced singly, usually 4-armed, main axis 57–108 ($\bar{x}$ = 84) × 9.3–14.5 μ, of 5–8 cells; divergent arms septate, arising from the second cell of the main axis, 10–136 ($\bar{x}$ = 87) × 2–3.5 μ, constricted at the point of origin; resting cells in branching chains, 5–23 μ diam.

HOLOTYPE: Hawaii. On leaves in water from Kokee stream, Na Pali Kona Reserve, Kauai, August 30, 1961, *Anastasiou H47*. Transfers of this holotype have been deposited at ATCC, CMI, CBS, and DAOM.

Dactylella appendiculata is characterized by the production of aleuriospores developing one to four determinate, lateral arms from the second cell of the main axis (Fig. 1*g–i,* Fig. 2*c–f*). These arms are formed consecutively from the apical portion of the second cell. In other species of *Dactylella* (Drechsler, 1937:489, 493, 501) germ tubes usually arise from the apical portion of this cell. In *D. appendiculata* the arms are distinctly constricted at the base but a wall does not appear to be laid down at this point. However, septation occurs distally in the arms. The main axis of the aleuriospore develops into a form (Fig. 1*j,* Fig. 2*c*) characteristic of many species of *Dactylella* if the spore primordium is initially straight. If the spore primordium is curved, the main axis appears as in Fig. 1*i* and Fig. 2*d–f*. Fig. 1*a–i* and Fig. 2*a* are stages in the development of spores of the second and predominant type. Fig. 2*b* is a stage in the development of a spore of the first type.

In the original collection conidiophores were produced from submerged hyphae and emerged to about 200 μ above the water surface. At maturation, the spores dropped to form a dense mass floating on the surface tension membrane. Sporulation did not occur in pure culture on agar. However, when a portion of the colony on agar is submerged in water, very weak sporulation occurs after 3 to 5 weeks' incubation at room temperature. Increased sporulation, though still sparse, occurs when a rotting leaf is sterilized with the water before inoculation.

Since this species resembles certain predaceous species of *Dactylella,* it was cultured in water containing nematodes and rotifers. No predaceous apparatus was formed, whether or not these organisms were present. No improvement in sporulation occurred after addition of nematodes, but when water containing rotifers and other microorganisms was added spores were abundantly produced on the surface of leaves in the culture. Almost all spores developed on short aleuriophores (up to 150 μ) and were completely submerged at maturity. All of these developed from curved spore primordia. Some of the spores produced above the surface of the water developed from straight spore primordia.

Germination of aleuriospores occurred mainly by germ tubes from the apical and basal cells of the main axis as well as from any cell of the divergent arms. Germ tubes arising from the main axis are only slightly constricted at their point of origin, where a distinct septum was usually observed. Germination from the divergent arms is normally by branching rather than elongation of the arms.

The colony on MeYe agar (Benjamin, 1959: 322) was slimy and dull white in color, with very little aerial mycelium. In age, branched chains of yeastlike resting cells were produced (Fig. 1*k;* Fig. 2*g*). Similar resting cells developed in the water of the original isolate and subsequent transfers.

The relationship between *Dactylella appendiculata* and other species of *Dactylella* is comparable to that between *Campylospora chaetocladia* and *Tripospermum.* In spore morphology, *C. chaetocladia* differs from *Tripospermum* by the production of filiform appendages at the apex of the arms. Some justification for placing *C. chaetocladia* in a separate genus is to be found in differences in conidiophores and spore color (Ingold and Cox, 1957:320; Hughes, 1951: 22). Such differences between *D. appendiculata* and *Dactylella* do not exist. In my opinion differences in habitat and modification of germ tubes to form spore branches do not constitute sufficient reason for placing this organism in a genus which does not show its true relationship.

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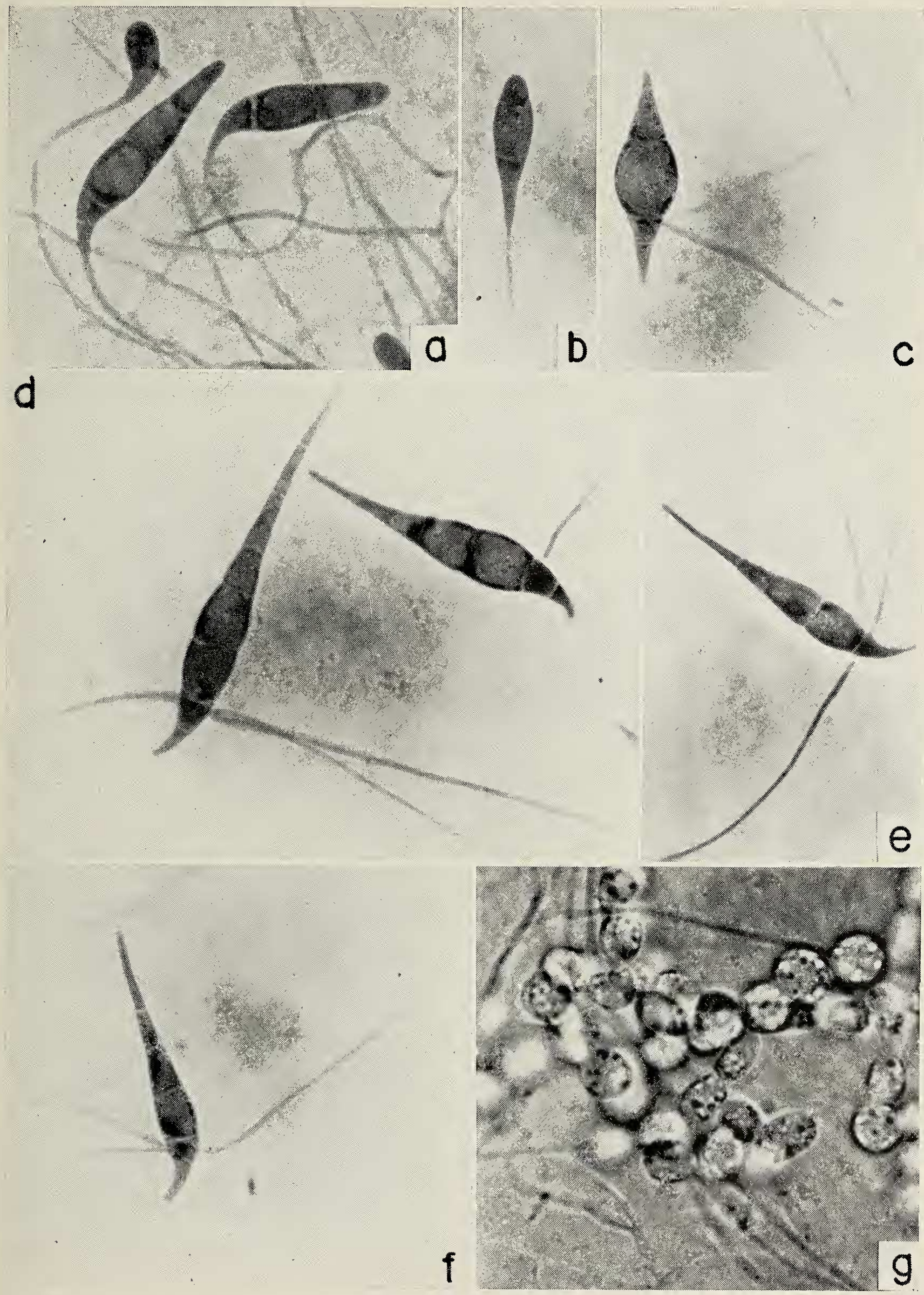

FIG. 2. *Dactylella appendiculata. a–d:* Stages in the development of aleuriospores from curved spore primordia. *b,* Two-celled stage in the development of an aleuriospore from a straight spore primordium. *c,* Mature aleuriospore from a straight spore primordium. *e, f,* Mature spores from curved spore primordia. *g,* Resting cells from water culture. ×556.

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